ADAP Demonstration of Breeding Swine Through Use of Artificial Insemination
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Best Practices for Artificial Insemination of Swine in the Pacific Islands

ADAP PROJECT

Agricultural Development in the American Pacific:
Research and Extension Programs

Best Practices for Artificial Insemination of Swine in the Pacific Islands

Artificial insemination of female swine can help to improve the quality of offspring and greatly reduce the impact of inbreeding in a swine population. This publication provides step-by step guidance in determining female heat, ordering semen, thawing semen, inseminating female swine, cleaning up at insemination, and detecting pregnancy. It also has a list of current suppliers of boar semen who can ship to the Pacific.

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Recommendations based on Efforts in the Western Pacific

Initial results of AI in Saipan, Tinian, Pohnpei, Kosrae and Guam are encouraging. First generation offspring from AI have been produced to replace old broodstock. The success of AI in the region will depend on hog producers, the personnel assigned to the program, and support from the local government.

Hog producers must strive to improve sow management, heat detection, and maintaining farm records. Piglets produced from AI must be given extra care and should only be used for replacement of breeding stock.

Land Grant and local Agriculture staff must be given continuing training and education in AI, swine production, and management. They must take care of AI equipment and supplies. Proper processing of semen and insemination procedures must always be complied with.

Local government should provide funding for the program to continue. Minimal fees can be collected for AI services. Fees collected can be put into a revolving fund to ensure continuity of the AI program in the region. For more information and details, contact your local Cooperative Extension Service or agricultural advisor.

Best Practices for Artificial Insemination of Swine in the Pacific Islands

Introduction

Healthy, fast growing and highly productive swine is a goal of every swine producer. Breeding plays an important part in this goal and it can be done by "natural service" or mating, or through "artificial insemination."

Artificial insemination (AI) is a technique for breeding swine that allows you to use fresh or frozen semen from select boars a great distance away to impregnate sows and gilts. AI can help to greatly reduce the incidence of inbreeding, the breeding of closely related animals, which can result in low productivity and inferior offspring. Although the use of artificial insemination has continued to grow dramatically worldwide, inbreeding is extremely common in isolated farming communities.

In many countries, AI is being introduced by educational institutions and departments of agriculture. Ideally, you are better prepared if you have participated in a demonstration of the technique with a trained professional before you try it unassisted. But the following procedures outlined in this publication should be sufficient to help you make an informed attempt at the process. Note: some key information in this publication came directly from a University of Missouri-Columbia publication written by Jodi Sterle and Tim Safranski called *Artificial Insemination in Swine: Breeding the Female*.

Artificial insemination in swine is not a new technique. The collection of semen for insemination has been reported as early as the 1930s. AI is not an experiment. If you are interested in improving your herd's genetics, you should reserve your BEST sows and gilts for this purpose.

Because of the dynamics of AI technology, it is continually and constantly changing to meet the challenges and demands of producers and consumers. Such improvements are also important to the Pacific Islands where good quality breeding stock is scarce and difficult to acquire. Some of the benefits that are derived from AI are genetic improvement, biosecurity, and improvement in the quality of carcasses.

Overview of Artificial Insemination

It is important to remember that AI is a tool that will work for your operation only if you are willing to manage and use it properly. AI can be used to bring new and more favorable genetics to the herd without the high costs and disease risks associated with shipping live boars. Regardless of the size of operation, using AI can provide a means of making genetic improvement in swine. In contrast to natural service, other advantages of using AI include:

- Requires few, if any, boars for actual insemination but it is good to have one around for "inspiring" certain mating behaviors.
- Genetic improvement may occur more rapidly.
- Reducing (but not eliminating) the risk of disease transmission.
- Pigs tend to be more uniform in size and appearance because fewer sires are used.
- Time required for breeding may be reduced.
- Less stress on breeding herd especially in summer heat.
- Risk of injury to breeding partners is greatly reduced: any size boar (via its semen) can be mated to any size sow/gilt.

If you are considering the use of AI, over or in conjunction with natural service, you should consider the above benefits in balance with these potential problems:

- Requires higher level of management.
- Storage of semen, once it is been mixed with the extending liquid, is limited.
- Sanitation of equipment and workers hands is a must.
- Accurate heat detection is critical for AI success.
- Workers need to be well trained and practiced.
- There must be good record-keeping for each individual sow and members of a litter.
- Piglets will need extra care and proper nutrition. They will not reach their maximum growth of fed with wet garbage or local feed stuff such as bananas, taro, etc.

Also, unlike natural service, where the boar knows exactly when to mate, the semen is at the optimum temperature and condition, and the boar will mate several times during the ideal period. AI, by contrast, requires a lot more intervention on your part as the producer.

You must be with the sows/gilts frequently in order to note certain changes and you must be able to recognize when

Gilts and sows should be as calm and relaxed as possible before, during and after the insemination process.

sows and gilts are coming into heat. This requires that the sows and gilts be at ease around you (Image 1). The animals to be bred should be coaxed, not driven, as they must be stimulated to activate uterine contractions. You must carefully check on the sows and gilts twice a day to determine optimal mating time. Likewise, the semen must be protected from environmental stress such as sunlight, too much heating or cooling, or preparation with impure water. You must also perform AI twice, per animal, during the optimal period to increase the success of the insemination process.

Disease Risk

Some diseases can be transmitted through semen, but the risk is much lower using semen than with exposure to live boars. Commercial semen suppliers have strict health controls, including quarantine of new animals, testing for specific diseases (usually brucellosis, pseudorabies, TGE, leptospirosis, PRRS and tuberculosis), vaccinations (usually erysipelas and parvovirus), and parasite control programs. Antibiotics are added to the semen with the extender. If concerned, check with the supplier about their specific health program before ordering semen.

Consult with your area veterinarian with regards to vaccination program for breeders before AI is considered. Below is a list of typical vaccinations that you may be necessary. Check with your local veterinarian to see what is recommended.

VACCINATION SCHEDULE FOR SWINE IN THE PACIFIC

Type and Age of Pig	Vaccine	Other Management Essentials
Gilts, 6 months old, or at least 5 weeks before breeding	Parvovirus Leptospirosis Erysipelas	Treat for worms and mange
Gilts and Sows, at least 2 weeks before breeding	Parvovirus Leptospirosis	
Gilts, 5 weeks before farrowing	If there is a specific herd problem, vaccines for Colibacillosis, Atrophic Rhinitis, etc., can be used.	
Gilts and Sows, 2 weeks before farrowing	Erysipelas If there is a specific herd problem, vaccines for Colibacillosis, Atrophic Rhinitis, etc., can be used.	
Sows, 2 weeks before weaning - see Gilts and Sows before breeding		

Artificial Insemination Procedure

As noted above, artificial insemination can provide a great number of benefits, but it can also be an expensive process with limited success if the following best practices and semen–supplier advice are not followed closely.

If your country is fortunate enough to have a trained AI technician, it is best to meet with them at least six weeks or more before the first attempt at AI. You will be ordering semen from a particular line of animals, such as Yorkshire or Duroc, and will need at least one semen sample for each female you wish to inseminate, and perhaps two samples for each animal to make sure that the insemination was successful–usually you will inseminate the same animal two days in a row.

The technician will advise you of the signs of heat and demonstrate the visual inspection method of detection, and if available, the proper use on an electronic heat-detecting device (Image 2). Knowing how to detect heat properly will eliminate unnecessary ordering or thawing of semen because an animal is not really ready to be mated (in heat). If no technician is available, careful reading of this manual should provide you with all the information you need to successfully inseminate your sows/gilts.

Heat detecting device, such as a Walsmeta Heat Device, assists in monitoring standing heat.

It is ideal to do insemination in the early morning or late afternoon because the weather is cooler, but office hours of technicians can make it difficult to follow that schedule. Most inseminations occur between 10:00 a.m. and 3:00 p.m. You are advised to make the necessary arrangements to cool down and relax your animals for the day of the insemination procedure. These preparations are important because animals may become nervous and uncooperative in the presence of an unfamiliar person performing AI.

The Necessary Pen Structures for AI

Unlike natural service, AI requires the ability to separate sows and gilts from boars to eliminate early insemination. Thus having a shaded pen with secure fences and at least two sturdy pens, one for the sows and gilts and one for a boar, is a must.

When are Sows and Gilts Ready for Natural Service or Artificial Insemination

Gilts will start demonstrating estrous or heat (when sows are receptive to mating/insemination) at around 4-5 months

old, but insemination, either by natural service or AI should be delayed until they are at least 6-7 months old and 180-200 lbs. body weight. At this age and weight, the gilts are sexually and physically mature to handle the stress of pregnancy.

Estrous Detection, Synchronization, and Inducement

By far the most important aspect of AI is detection of the beginning of estrous. It is absolutely vital to the success of each breeding cycle for you to be accurate in estimating this event. It is also very important that you spend enough time with the sows and gilts before AI to gain their trust and to notice the conditions that announce the beginning of estrous.

Sows generally come back into their estrous period 3-10 days after the piglets have stopped nursing. Sows that nurse their piglets more than 30 days may not be able to come into estrous within 3-10 days after the secession of weaning, depending on their body condition. Ovulation usually occurs 23 to 48 hours after the onset of estrous; however, this event is extremely variable. This is why sows should be inseminated more than once during the current heat period and why estrous detection should be done twice a day during the time that heat is suspected, even though it requires more time and labor – this is the commitment part of using AI.

In order for AI to be performed in an efficient manner and only once or twice a month, it is important to synchronize the heat of the breeding females. Heat synchronization means to have the available swine sows and gilts demonstrate heat at the same time or at close intervals of 1-2 days. This is where good records come in; it is easier to predict when the heat will start if you know when the animals were born and weaned from their mother. Hormone preparations such as PG-600 and Cyclo Plus (available from AI and veterinary supply stores) can also be used to induce synchronous heat in collection of breeding females. These hormones can induce heat in sows and gilts within 3-5 days after injection. Developing heat synchronization within a breeding stock can really help reduce the costs and time involved with AI.

Signs of estrous may or may not include the following:

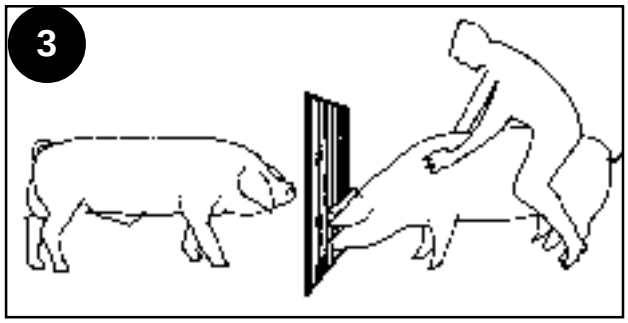
1. Swollen and pinkish or reddish vulva. The vulva is the most external part of the female reproductive tract.
2. There will be a mucus discharge from the vulva.
3. Sows and gilts are more restless than normal and either mount, or allow themselves to be mounted, by other females in the pen.
4. Sows and gilts make more grunts than usual.
5. When pressure is applied to the hind portion (Image 8), sows and gilts stand still and ears are erect in common anticipation of being mounted by a boar.
6. If available, a positive reading is detected with an electronic heat device such as the Walsmeta Heat Device (Image 2). When the probe is gently inserted in the female reproductive tract, the indicator lights turns red within the red zone area marked in the device.

Again, estrous detection in an AI system is vital to the success of breeding. You must be accurate in estimating the onset of estrous so that semen can be ordered and arrive in time and for the semen to be prepared for the insemination process. Proper detection can be achieved with twice-daily observation and/or with the use of the electronic heat device. Checks should be done at intervals of around 12 hours or as close to that as possible. It is best to perform estrous detection in the morning, before feeding or at least an hour after feeding. If this is not possible, perform detection in the afternoon or when the air temperature is cooler. You will know when it is the best time for the sow or gilt to be inseminated because:

1. The reddening, on the inside surface of the vulva, is starting to fade. Look for this paleness by gently spreading the lips of the vulva and looking inside the surface.
2. Mucous in the vulva, which has been thin and watery, becomes thick and more opaque.
3. At least 12 hours after the onset of standing heat.
4. You can sit on the female's back without her objecting.

Preparing the Sow and Gilts for Insemination

Before preparing the semen you MUST know that the sows and gilts are in "standing heat" (ready to be bred). When this time comes, they should be kept quiet in their normal surroundings or placed in a neutral pen where face-to-face contact with a boar, through a secure fence, if possible (Image 3). The breeding experience must be as calm and pleasant for the female as possible in order for the natural contractions, that are necessary to transport the semen to the uterus, occur. If the females have to be moved to a location other than their typical home, it should be done calmly.



Riding the sow in the presence of a boar is the ultimate test for standing heat.

It is a good idea for you to evaluate the quality of a representative sample of semen before time and effort is spent with insemination. The evaluation can be done with a microscope (Image 4). Shipment, dilution, storage, or exposure and length of time since collection may all affect the shelf life, motility and viability of semen. When conducting a motility test, check with the supplier as to the type of semen extenders being used. Each supplier uses different "extenders" that affect motility of sperm. An extender is a fluid that adds to the volume of liquid the sperm can move around in. Some extenders have special chemicals

that make sperm active right after thawing and some extenders will keep sperm inactive for a period of time even after thawing. Thawing procedures can also affect motility of the sperm. Ask the semen supplier for specific thawing procedures to run motility tests. The following are general guidelines for performing motility tests:

1. Read all the instructions provided by the semen supplier well before thawing and testing.
2. Place a drop of semen from the semen bottle on a prewarmed slide. Cover slide with cover slip and examine under the microscope. Use low power to find sperm and then shift to high power for closer observation (Image 4).
3. Sperm must have forward motion and movement. Clumping of sperm may be present. Evaluate and grade movement accordingly by estimating the percentage of moving or mobile sperm within one microscopic field. For example, if you think half of the sperm are moving in a field that you focussed on, the motility is 50%. The point here is that as long as you see some sperm moving, slow or fast, you should be confident that some sperm are alive.
4. Use caffeine-coated slides, if possible, to activate sperm right away. These slides are available from AI suppliers.
5. Always check sperm motility in the lab after thawing and again in the lab after insemination.

Using a microscope, assess whether sperm are active.

It is most important that ALL procedures be carried out exactly. If there is uncertainty on the part of the swine owner or AI technician it is important to take the time to practice all the procedures involved in AI before thawing any semen.

Semen: Which is Better, Fresh or Frozen?

Boar semen is available in fresh and frozen forms. There is a higher chance of successful insemination with fresh semen, but it is also more expensive and does not usually survive long distance travel. Frozen semen, by contrast, is cheaper and has a slightly longer shelf-life than fresh so it can travel to just about anywhere in the Pacific, but again has a lower fertility rate on average.

The AI Supply and Equipment Kit

General supplies

1. Antibacterial hand soap
2. Disposable *vinyl* gloves
3. K-Y jelly or neutral, non-spermicidal lubricant
4. Rubber apron
5. Color code list of straws representing different boar breeds.

Fresh semen

1. One sample for each animal for each insemination
2 Microscope and caffeine-coated slides
3. Catheters or spirettes**–1 per animal**
4. Clean cloths or paper towels
5. Scissors

Frozen semen

1. One sample for each animal for each insemination
2. Freezer
3. Water bath or hot water from a tap
4. Gloves that can withstand extreme temperatures.
5. Safety glasses
6. Thermometer
7. Watch or clock with a second hand
8. Flask/container for thawing extender materials
9. Extender bottles (should come with shipment)
10. Scissors
11. Measuring cup/graduated cylinder
12. Distilled water (or clean water boiled and cooled)
13. Large pan or sink for thawing semen straws
14. Microscope and slides, caffeine-coated slides are preferred
15. Catheters or spirettes**–1 per animal**
16. Insulated (styrofoam) container
17. Clean cloths or paper towels

In any case, here is some advice for preparing either of these forms of semen for use in the field. You will also need to acquire the appropriate supplies from the box labeled "AI Supply and Equipment Kit". If there is uncertainty about any part of the process, it's wise to practice each one of the procedures as many times as it takes to gain the necessary confidence. As always, follow the supplier's directions in addition to the information given below.

Handling and Transporting Semen Bottles to the Farm

Semen bottle(s) must be securely packed in a styrofoam container. Avoid vibration to prevent shock to the semen. Do not expose semen to direct sunlight.

Preparing Fresh Semen

1. Keep semen in styrofoam shipping container it came in until use.
2. Keep semen inside the shipping container in an air-conditioned room until use.

3. Just before insemination, place semen container in a shirt pocket to warm to human body temperature.
4. Gently invert the semen container several times before insemination. **Do not shake the semen to mix it**.

Preparing Frozen Semen

Frozen semen comes in a container that looks much like a drinking straw. These straws are kept very cold inside a stainless steel container surround by liquid nitrogen. One straw is required for each animal to be inseminated. Semen supply companies will specify how their product is to be thawed and prepared. Be sure all necessary equipment is thoroughly sanitized and available before beginning the procedure. Ideally, preparation of the semen should be done on location at the farm. The sows and gilts should already be in the holding pen and all preparations to move a boar into face-to-face contact, through a sturdy fence, with the swine to be bred should have been made. Delays between the time the semen is thawed and its insertion will decrease the success of the operation.

Preparing Semen Extenders

Always follow the manufacturer's procedures on the package. General guidelines for preparing semen are as follows.

1. Be sure all necessary equipment is thoroughly cleaned and available before beginning the procedure.
2. Add contents of the package of the semen extender to a container holding 1 liter (33.8 oz or 4.2 cups) of distilled or deionized water.
3. Mix extender and water solution well by shaking.
4. Pour 80ml (2.7 oz or 0.34 cups) of the mixture into each semen extender (insemination) bottle you will be using. The bottles of extender solution may be stored in a freezer at -20°C (-4°F) until ready for use.
5. If necessary supplies/equipment are not available in your area to mix the extender, contact your AI supply store to send you mixed, ready-to-use extenders. Freeze the extenders upon receiving them.

Following is an example of a thawing procedure recommended by Swine Genetics Incorporated. If you are ready to inseminate the sows/gilts, follow the general guidelines for preparing the semen extender solution before continuing with these next steps:.

6. About 45 minutes before you expect to inseminate the sows/gilts, remove the insemination bottles from the freezer and place them (one for each semen straw to be used) in a hot water bath. The water should be hot but not boiling. With a thermometer, monitor the water temperature until it and the insemination bottles reach 20°C (68°F).
7. Note that a jar that holds 500ml (16.9 oz or 2 cups) of 50°C (122°F) water will thaw a single insemination bottle and bring its temperature to 20°C (68°F) in about 35 minutes. Be sure to check the thermometer before continuing.

Refer to your color code list to facilitate removal of correct straw from tank.

8. Quickly lift the canister out of the liquid nitrogen tank just far enough to grasp a semen straw and place the straw in the 50°C (122°F) water bath for exactly 45 seconds (Image 5).
9. Return the canister to the liquid nitrogen immediately. [The liquid nitrogen in the tank should be kept at a minimum level of 20cm or 8 inches.]
10. Check your color code list to make sure you have the correct straw. [Make a list for yourself ahead of time.] The color of the straw cap represents the breed of the boar. For example, a red cap could represent the Duroc breed, a green cap the Hampshire breed, etc.
12. The straw should be in the 50°C (122°F) bath for exactly 45 seconds. Do NOT try to hold the straw during thawing. If you need to thaw more than one straw be sure to maintain the water in the bath at EXACTLY 50°C (122°F) (Image 6).
13. Remove the straw from the water bath and dry the straw thoroughly with a clean paper towel.
14. Holding the straw upright, snip the upper tip of the straw with a pair of scissors.
15. Place the cut end over the opened bottle of extender solution and snip the other end to allow the semen to drain out of the straw and into the bottle. Since the semen in the straw is a thick concentration, some of the

Check for correct temperature reading prior to mixing extender and sperm.

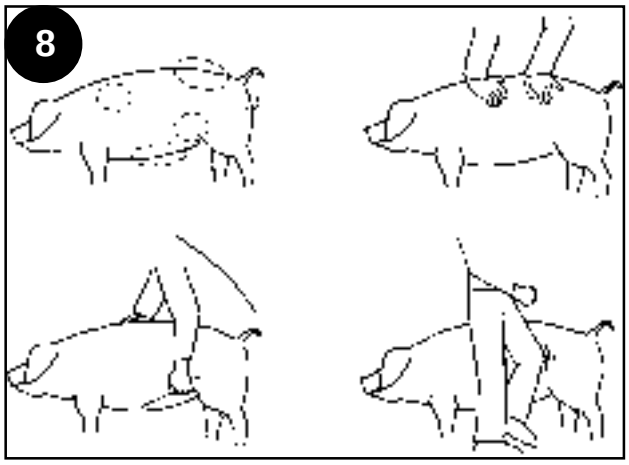
semen extender solution should be sucked back into the straw and allowed to rinse out the remainder of the semen.

16. Do this several times. The semen and extender solution should be kept between 20°C and 27°C (68°-80°F).
17. Gently invert the semen container several times before insemination. **Do not shake the semen to mix it** (Image 7).
18. Insemination should take place as soon as possible, ideally within 30 minutes, after thawing.

Handle mixed extender and semen gently to prevent shock to sperm.

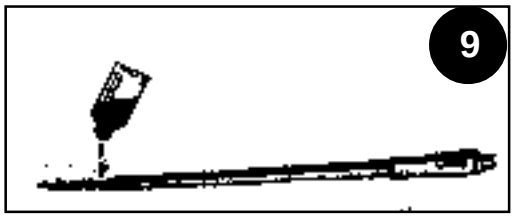
The Insemination Process

1. Wash hands before bathing the sow then proceed to wash the area around the sow's vulva using vinyl gloves, water and a clean paper towel. Do not use latex gloves or soap as they will act as a spermicide.
2. Bring a boar into proximity of the female either in a secure passageway or in an adjacent pen. The presence of the boar will make the females more receptive to breeding.
3. Stimulate the sow by continually applying pressure on the hind back area or rubbing the sides of the stomach. The breeder should be trying to mimic the boar, and the breeder who takes the extra time and effort to imitate this well will have more success with AI (Image 8).



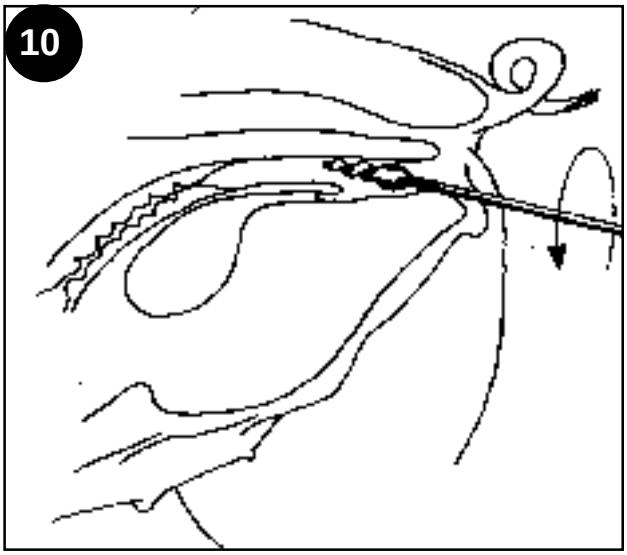
Areas on the sow that respond positively to stimulation during heat detection.

4. Lubricate the tip of a spirette or catheter ("catheter" will be used to discuss the procedure for the rest of this publication) with light, non-spermicidal jelly [such as K-Y jelly], or with a few drops of semen or extender (Image 9). Make sure not to get any lubricant on the tip of the catheter because it may plug the hole.



Lubricate the catheter with lubricant jelly or a few drops of semen to make insertion in the sow easier.

5. Gently insert the catheter with the tip pointed up into the vulva and upward (45º angle) into the vagina. The tip of the catheter is usually shaped like a boar's penis. Care should be taken to insert it at an upward angle to prevent inserting it in the bladder. The bottle of semen solution is not attached to the catheter at this point, as a backflow of urine would kill the sperm (Image 10).

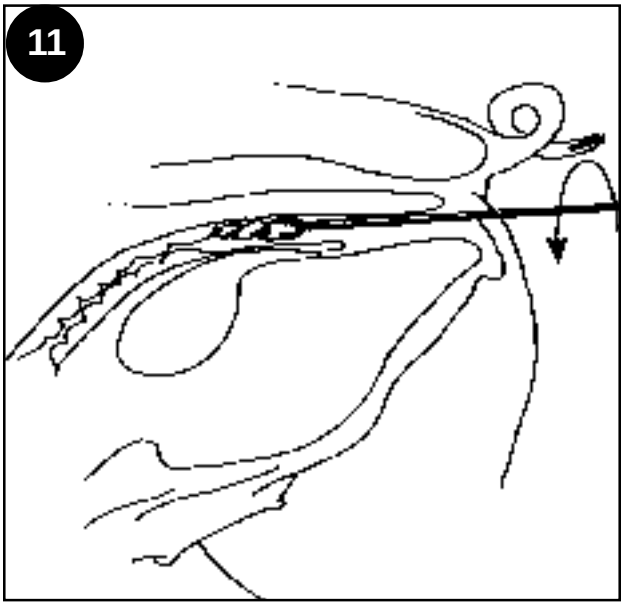


Ensure that the tip of the catheter follows the dorsal or upper surface of the vagina.

6. When resistance is met [approximately 20 to 30 cm (8 to 12 inches) into the vagina] twist the catheter **COUNTERCLOCKWISE**. Gently pull back on the catheter to make sure it is locked in place. The catheter should stay in place when pulled back gently (Image 11). Firm pressure will cause it to engage in the cervix.
7. When the catheter is in place, cut off the tip of the semen bottle and connect it to the end of the catheter (Image 12). Apply gentle pressure on the bottle so the semen will flow freely inside the uterus. In some cases, the sow's uterine contractions 'absorb' the semen with-

out any need for putting pressure on the bottle. DO NOT TRY TO FORCE THE SEMEN INTO THE UTERUS. If the semen does not flow, try to move the catheter with gentle pressure on the bottle until the semen starts to flow, or put pressure on the back of the female and stroke the flanks to encourage uterine contractions. A small backflow of semen is expected. If an excess of semen is leaking out of the vulva, or if the flow is blocked, stop the insemination and give the catheter a gentle quarter turn COUNTER CLOCKWISE to reseat it. The process should take about 3 to 6 minutes.

8. Once the bottle is emptied, disconnect it from the catheter. Put your thumb on the end of the catheter and rotate it clockwise while pulling it out gently.
9. Newly inseminated sows should be individually penned to keep them calm. Distress at this time may still disrupt semen transport and fertilization.
10. Twelve to 24 hours after the first insemination, check the heat status of the inseminated sow. Then prepare to inseminate her a second time.
11. Keep written records of insemination activities and observations such as behavior of sows, volume of backflow, bleeding, etc.



Turn the catheter counterclockwise to lock in the cervix.

Checking for Pregnancy After Artificial Insemination

1. Check for return to estrous 18-21 days after insemination. Absence of heat indicates pregnancy. If the sow comes back in heat, you can use AI again or natural breeding.
2. With the use of a pregnancy-testing device such as RENCO® ultrasonic pregnancy tester. Aim the ultrasound toward the sow's body to scan across the uterus. The best site for testing is located one inch above the nipple line and two inches in front of the rear leg. This will prevent a false positive reading. Test for pregnancy 30 days after insemination.

The bottle of semen is attached to the catheter and the semen is injected into the sow. It will take about 3–6 minutes to empty the bottle.

3. Check for return to heat 40-42 days after insemination. Absence of heat can be a sign of pregnancy.
4. At 60 days after insemination, abdominal enlargement can be observed in the animal.

You are advised to check your sows regularly for the recurrence of heat after insemination.

Frozen Semen and AI Supplies

Contact your Department of Agriculture for information concerning the importation of semen and make sure to obtain *all* necessary forms. Select a semen supplier (see list at end) and order the semen you want. Your extension agent or agricultural advisor may be able to help you with this.

If you plan to order many semen doses at one time you will save money on shipping. You should, however, check on the nearest supply of liquid nitrogen in case you need to add to the supply in the storage tank and be sure to order ahead of time in case of delays. Liquid nitrogen can last a few weeks if handled properly. Normally a full canister is shipped to be exchanged with the depleted one. The straws in the supplier's canister should be transferred as quickly as possible to the new tank to avoid damaging the semen. Liquid nitrogen is available in Suva, Fiji and Agana, Guam, as well as Australia, Hawaii and New Zealand.

Ordering Frozen Semen

The Supplier

1. Contact a supplier of semen and AI supplies and request their boar catalogue, brochures, and price quotes of their merchandise. See the end of this publication for a brief listing.
2. Establish an account with the prospective AI clinic/supplier in the U.S. mainland. This can be accomplished through a purchase order or a prepaid account.
3. Send your order indicating the breed preferences, the

number of straws (semen doses) per breed, and a list of necessary AI supplies. You can send orders through fax, e-mail or phone.
4. No matter which company you choose to supply your fresh or frozen semen, a certificate of veterinary inspection (U.S.) and/or an International Animal Health Certificate must be issued on behalf of the supplier.

This certificate must be presented to the appropriate officer in the importing country who will issue a permit to import semen. Once again, these requirements apply to both fresh and frozen semen. This certificate indicates the semen has been properly screened for communicable diseases and identifies the herd, type and quantity of semen being exported attesting that the donor animals:

- showed no clinical sign of disease on the day of collection and, except for fresh semen, for the following thirty days;
- were kept in a country internationally recognized as free from OIE (Office International Epizootics) List A diseases affecting domestic ruminants and pigs since birth or for not less than six months prior to collection.

The Cargo

1. When the semen tank arrives, verify that the tank did not tip over during transit. There typically is a warning label on the tank that indicates whether the tank is in good condition upon arrival. Refill with liquid nitrogen if necessary.
2. The semen must be kept frozen in portable, liquid nitrogen, storage tanks.
3. Liquid nitrogen is a HAZMAT (hazardous material) product and as such, can only be shipped by air on *cargo* aircraft and *must* be accompanied by a Shippers Declaration for Dangerous Goods. This form is normally the responsibility of the company supplying the liquid nitrogen and its container. For more remote island localities the semen and liquid nitrogen must be shipped by boat. This is no problem for frozen semen, as it will keep in the canisters for many weeks or months if handled properly.
4. Most air freight and ship cargo handlers are inexperienced in the handling of liquid nitrogen canisters and need to be informed ahead of time of the special handling instructions. These instructions include never tipping the canister and keeping the canister in a cool, shady place.
5. If the tank is in bad condition, file a complaint with the airline and notify the supplier immediately. The supplier will provide instructions on how to handle damaged shipments.
6. Keep the semen tank in an air-conditioned room at all times, away from doors and heat.
7. Advise supplier to use the most direct flights to your area for shipping the tank.

Handling the Semen Tank

1. Do not drag across floors or bang into doors and walls. These actions may lead to inner neck tube breakage.
2. Avoid dents and scratches.
3. Set tank down squarely and gently in storage room.
4. Protect tank by storing it on wooden pallets or boards on concrete floor and out of direct sunlight and heat.

How to Order Liquid Nitrogen for Semen Tanks

Liquid nitrogen is used to maintain the frozen state of the sperm inside the semen tank. Liquid nitrogen is nonflammable, nonexplosive and nontoxic, but it can be dangerous if improperly handled as it can cause frostbite. Semen tanks must be refilled immediately with liquid nitrogen before the critical level of 5 cm (2 inches) is reached, as indicated by using a dipstick. If the level of liquid nitrogen goes below 5 cm, you will have to discard the sperm as it will no longer be reliable.

1. In, Micronesia, Guam is the only source for liquid nitrogen. Arrangements must be made with the Island Equipment Company on Guam. Fax number: (671) 565-4971; phone number: (671) 565-2483/4574-5.
2. Transportation of liquid nitrogen from Guam must also be arranged with the local airline in your area (Continental Airline, Freedom Air, and National Fisheries Corporation). Check flight schedules of these airlines in your area. In order to ship liquid nitrogen, a shipper's declaration for dangerous goods form must be filled out with the airline.
3. Due to heavy cargo flight schedules in the region, order liquid nitrogen well in advance to avoid delays. Semen quality will deteriorate when levels fall below 10 cm (3.9 inches).
4. Always wear gloves and safety glasses when handling liquid nitrogen. Liquid nitrogen is cold enough to cause frostbite in seconds. If contact is severe enough to cause skin to turn white, get medical treatment.

Ordering Fresh Semen

The procedure for ordering fresh semen is similar to that of frozen semen. The only difference is in the mode of transport and the schedule.

1. When ordering fresh semen, check with your supplier on their schedule of collection and shipment. Generally semen collection is done on Mondays and shipped on the same day through private express mail services such as FedEx, etc.
2. On Guam, for instance, fresh semen orders arrive on Thursdays and Fridays.
3. Fresh semen must be used within 7 days after the collection so you will need to work quickly when the semen arrives on your island.
4. Store semen in an air-conditioned room or special storage container at 60°F (15.6°C). Protect from light.

Caring for AI Supplies

1. Semen extenders must be kept in the freezer at all times. Thaw only when ready to use.
2. Heat detecting devices and pregnancy testers must be kept clean and protected from shocks. Contact suppliers when repairs are necessary.
3. Water baths must be tested for right temperature before thawing semen.
4. Spirettes/catheters should be used once and discarded.

Glossary

Artificial Insemination (AI). Collecting semen from a boar and depositing (inseminating) it into the cervix of a sow or gilt to achieve pregnancy.
Boar. A male swine that has not been castrated.
Catheter. A foam-tipped insemination rod.
Cervix. The muscular junction between the vagina and the uterus in the female. During the mating process, this portion of the female reproductive tract stimulates the glans penis of the male by muscular constriction, causing the male to ejaculate. The cervix is normally open when the female is in estrous, but is closed during the remainder of the estrous cycle and during pregnancy to prevent contamination of the uterus.
Conception. Fertilization of the egg or ovum by the sperm, resulting in an embryo. To "settle."
Crossbreeding. The mating of two animals of different breeds.
Estrous (Heat). The time when a female is "in heat" and will breed readily.
Farrow. Female swine giving birth.
Gilt. An immature female swine. A female is considered a gilt until she farrows her first litter, then becomes a sow.
Heat. See Estrous.
Semen. A mixture of sperm and accessory gland fluids produced by the testicles and accessory organs during ejaculation.
Sow. A mature female swine that has farrowed at least one litter.
Sperm. The male sex cell, produced by the testicle and carrying half of the genes of the boar that produced the sperm.
Spirette. A spiral-shaped, plastic-tipped insemination rod.
Synchronization. Any treatment, hormonal or managerial, that causes a large percentage of females to come in estrous at the same time. Treating gilts with progesterone or synthetic progesterone compounds has been effective in preventing estrous. These females then come in estrous at about the same time after hormone treatment ceases. Moving gilts out of confinement, followed by exposure to a boar, also results in synchronization of estrous in some gilts that are near puberty.
Uterus. That portion of the female reproductive tract in which embryonic and fetal development occur.
Vagina. That portion of the female reproductive tract extending from the cervix to the vulva.
Vulva. External structure of the reproductive tract of females.

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Appendix 1. Some commercial semen suppliers. This listing is not complete, is not an endorsement and is subject to change at any time.

Company Name	Mailing Address	Phone number	Semen available in these breeds
Alberta Swine Genetics Corp.	Box 3310 Leduc, Alberta T9E 6M1	1-403-986-1250	Yorkshire, Landrace, Duroc, Hampshire, Crossbred
Birchwood Genetics, Inc.	465 Stephens Road West Manchester, OH 45382	1-800-523-2536	Yorkshire, Hampshire, Duroc, Landrace, Berkshire, Chester White, Poland China, Spotted, Crossbred
Commercial Concepts	HC 80, Box 86 Needmore, PA 17238-9610	1-800-573-2522	Yorkshire, Duroc, Hampshire, Landrace, Spotted, Crossbred
Dekker N. America	8383 Greenway Blvd. Middleton, WI 53562	1-800-362-4647	Yorkshire, Duroc, Landrace, Hampshire, Crossbred
*International Boar Semen	R.R. 1, Box 118-A Eldora, IA 50627	1-800-247-7877	Hampshire, Yorkshire, Duroc, Landrace, Pietrain, Berkshire, Spotted, Chester White, Crossbred
Lean Value Sires	P.O. Box 620 Troy, OH 45373	1-800-972-8766	Duroc, Hampshire, Yorkshire
*PIC ASIA	37 Shuicheng South Rd. Shanghai, 201103, China	8-621-62702737	
SABOR LTD.	Clare, South Australia	6-152-555614	
*Swine Genetics International	Rt. 1, Box 3 Cambridge, IA 50046	1-800-247-3958	Yorkshire, Hampshire, Duroc, Landrace, Chester White, Berkshire, Spotted, Crossbred
United Swine Genetics	R.R. 2, Box 49 Roanoke, IL 61561	1-800-772-7340	Yorkshire, Hampshire, Duroc

* Denotes shippers of frozen semen.